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(54) Abstract Title
Modernisation of hydraulic elevators

(57) A method of retrofitting a hydraulic elevator arranged in an elevator hoistway so as to form a traction sheave elevator, said hydraulic elevator comprising a car (2) guided on car guiding rails (4), a hydraulic drive unit provided in the space between car (2) and hoistway wall (66), as well as a hoisting rope from which the car (2) is suspended and which has the hydraulic drive unit connected thereto, said method comprising the following steps:

(a) unmounting said hydraulic drive unit and said hoisting rope;
(b) installing a counterweight (22) with deflection sheave (56) in the space between the car (2) and the hoistway wall (66);
(c) installing a traction sheave drive unit (30) having a traction sheave (58) in said elevator hoistway such that the traction sheave drive unit is arranged in the space available above the car (2) and/or the counterweight (22);
(d) installing a deflection sheave (50) on the car (2);
(e) installing mounting means (38, 40, 42, 44) for mounting the ends of the hoisting ropes (46) at the top in the elevator hoistway; and
(f) installing hoisting ropes (46) such that these are passed around the deflection sheaves (50; 56) on the counterweight (22) and the car (2) and around the traction sheave (58) and are attached at their ends to a mounting means each.

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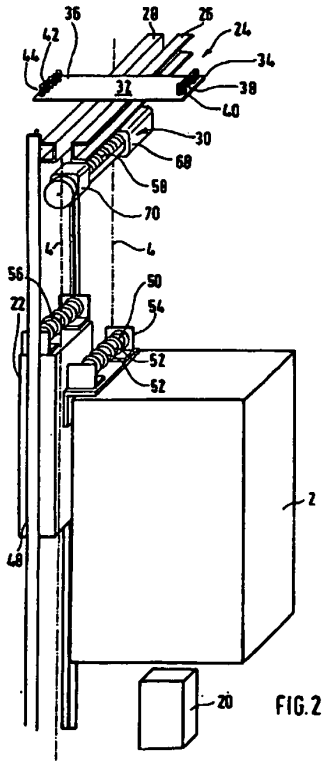

FIG.2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

(57) cont

Preferably, counterweight guide rails (48) are installed and the counterweight mounted between the car and shaft walls. The ropes (46) are preferably flat-bands and the drive a cylindrical motor (30). A retrofilling set, hoisting unit and traction elevator are also claimed.

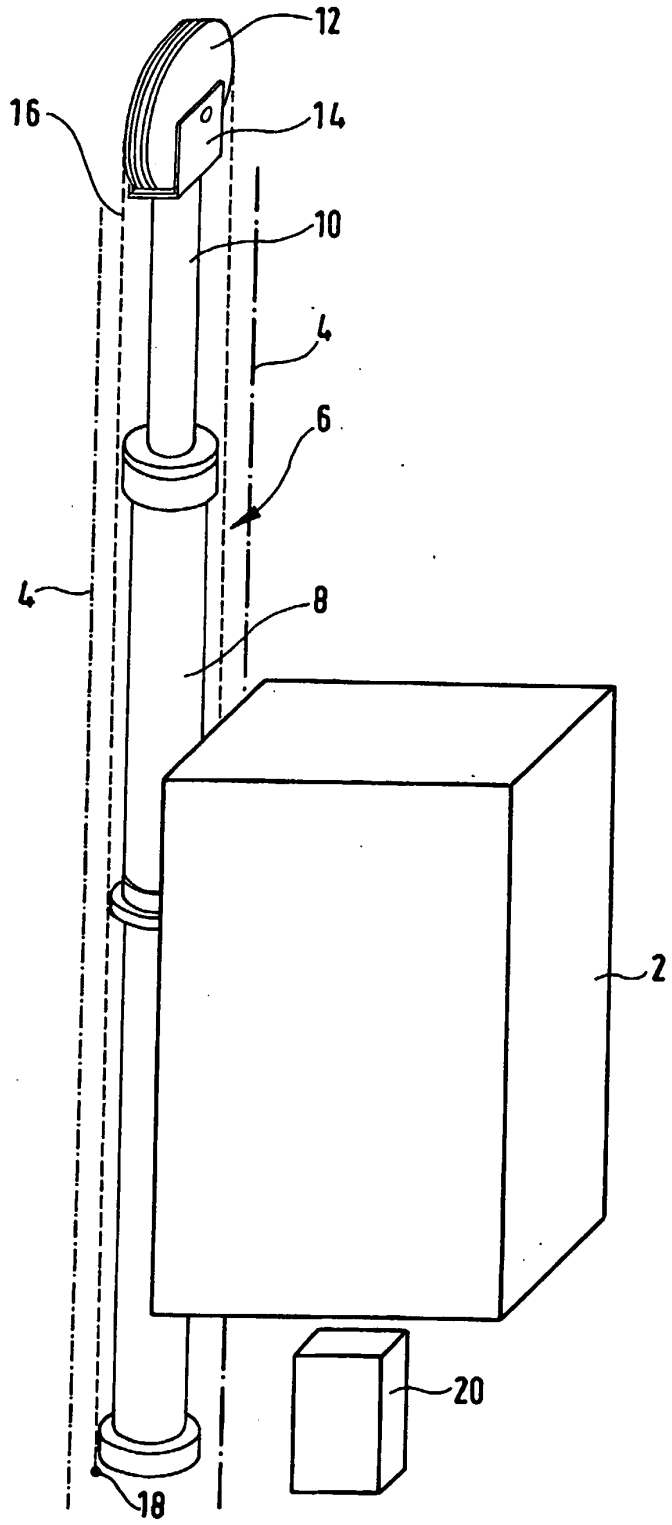

FIG.1

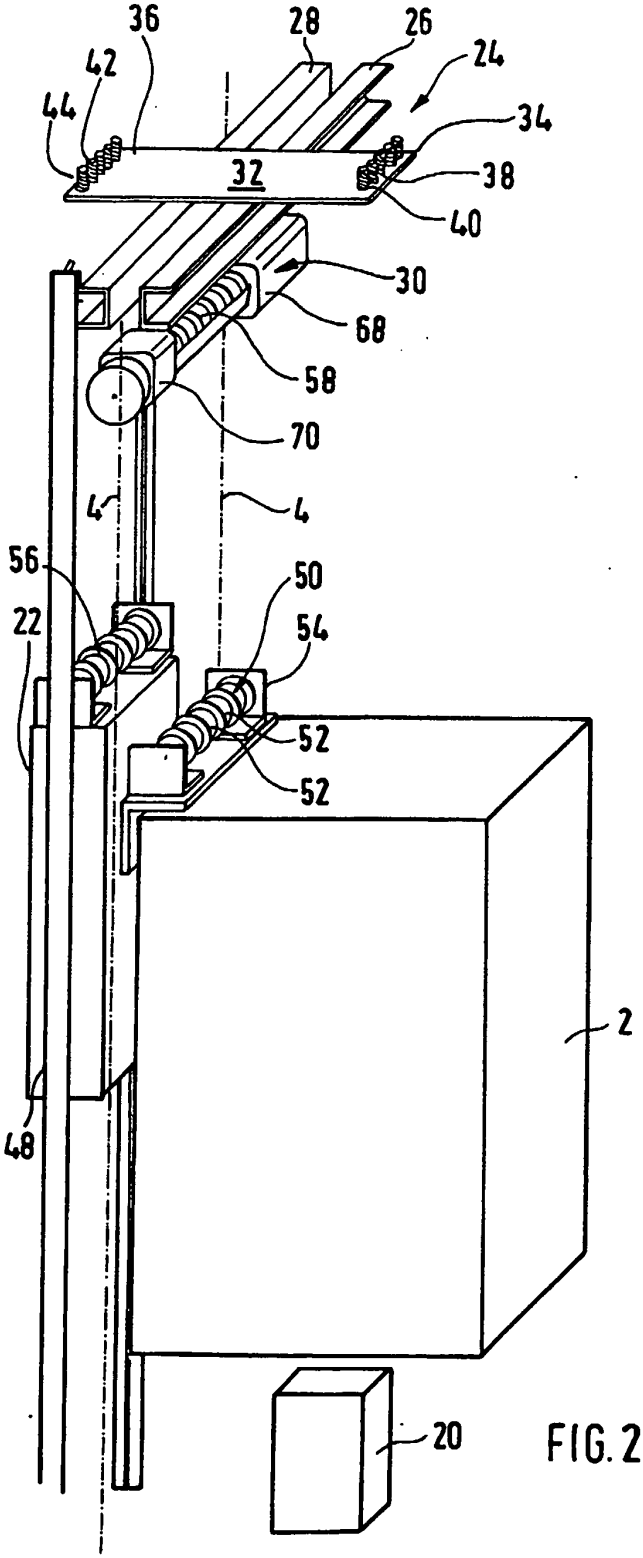
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FIG. 2

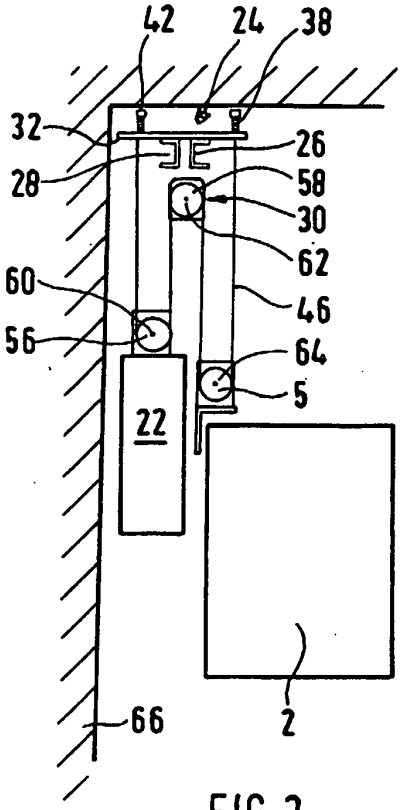
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FIG. 3

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Modernization of Hydraulic Elevators

The present invention relates to elevators and in particular to the environmentally friendly retrofitting of existing hydraulic elevator systems.

During the 70ies and 80ies, there was virtually a boom in the field of hydraulic elevator systems. These hydraulic elevator systems made available a reliable and relatively inexpensive possibility of retrofitting also fewer–storey buildings with elevator systems in relatively unproblematic manner. In particular, so called "indirect hydraulic systems", i.e. hydraulic elevators with 2:1 roping, were offered with essentially the same construction principle from a large variety of manufacturers and were installed in large numbers.

The general construction of such systems is illustrated in attached Fig. 1. The latter shows the elevator car 2 guided on guiding rails 4 illustrated schematically in the form of dot and dash lines. It can be seen that the guiding rails 4 are arranged on one side of car 2 such that the car is guided on the car guiding rails 4 in cantilever fashion. This principle of arrangement is referred to as "backpack–type". Furthermore, there is shown a piston and cylinder combination 6 arranged in the elevator hoistway on the same side as the car guiding rails 4 of car 2. The piston and cylinder combination 6 comprises the cylinder upstanding from the hoistway floor by way of a cylinder stand and acted upon with pressure from a hydraulic system (not shown). This hydraulic system, which is not shown, may be arranged either in the range of the hoistway, e.g. integrated with the piston and cylinder combination 6, or externally thereof. Moreover, there is shown the piston 10 having a deflection sheave 12 rotatably mounted on the upper end thereof. For reasons of stability, the piston 10 or the support 14, respectively, by means of which deflection sheave 12 is mounted to piston 10, is supported by a yoke (not shown) which in turn is guided on the car guiding rails 4. By this way of attachment of the free end of piston 10, stable

guiding thereof is ensured and lateral evasion is avoided. One or more conventional elevator hoisting ropes, illustrated schematically by broken line 16, is attached at one end 18 thereof in the region of the hoistway floor and passes from there substantially vertically upwards to deflection sheave 12 and over the same, from where it extends on again in substantially vertical downward direction. The second end of the hoisting rope 16 is connected to car 2. By this way of roping, the car 2, as compared to the deflection sheave 12 or the piston stroke, covers twice the movement distance. A counterweight typically is not provided in this type of elevator. The car 2 and the piston and cylinder combination 6 are typically accommodated in an elevator hoistway, with the hoistway walls being generally provided as close as to the individual components of the elevator system as is possibly permissible. This holds in particular for new buildings that were designed from the very beginning for operation of such elevators.

However, these hydraulic elevators, partly after more than 20 years of operation, now require a fundamental revision or modernization. In addition thereto, there is the fact that, in particular for reasons of environmental protection, the attitude towards hydraulic elevators changed fundamentally in the past. With hydraulic elevators, there is always the risk of leakage of hydraulic fluid. It has to be ensured, for obvious reasons, that this hydraulic fluid is captured and, in particular, cannot leak into the groundwater. Moreover, there is the relatively high demand of energy and maintenance expenditure of hydraulic elevators. Some elevator operators thus utilize the necessity of this basic modernization for completely removing the hydraulic elevator from the hoistway and install a traction sheave elevator in place of the same. This is equal to a new installation of an elevator.

A competitor of the applicant to this end offers a system in which the traction sheave drive unit, which is in the form of a flat disk, is arranged in the elevator hoistway, and conventional hoisting ropes are employed having the elevator car and a counterweight connected thereto. This kind of "modernization" by new installation of a traction sheave elevator has several disadvantages. On the one hand, the new installation of a completely new elevator system involves

corresponding costs. On the other hand, additional space is required for the drive motor and the associated roping, which may lead to a reduction in size of the elevator car.

It is therefore an object of the present invention to provide for a possibility of modernizing existing hydraulic elevators, which on the one hand is inexpensive and on the other hand eliminates the disadvantages of hydraulic elevators, such as energy demand and problems concerning the hydraulic fluid.

According to the invention, this object is met by a method of retrofitting a hydraulic elevator arranged in an elevator hoistway so as to form a traction sheave elevator, said hydraulic elevator comprising a car guided on car guiding rails, a hydraulic drive unit provided in the space between car and hoistway wall, as well as a hoisting rope from which the car is suspended and which has the hydraulic drive unit connected thereto, said method comprising the following steps:

(a) unmounting said hydraulic drive unit, inclusive of the cylinder stand, and said hoisting rope;
(b) installing a counterweight with deflection sheave in the space between the car and the hoistway wall;
(c) installing a traction sheave drive unit having a traction sheave in said elevator hoistway such that the traction sheave drive unit is arranged in the space available above the car and/or the counterweight;
(d) installing a deflection sheave on the car;
(e) installing mounting means for mounting the ends of the hoisting ropes at the top in the elevator hoistway; and
(f) installing hoisting ropes such that these are passed around the deflection sheaves on the counterweight and the car and around the traction sheave and are attached at their ends to a mounting means each.

In the retrofitting method according to the invention, in addition to the electric components of the elevator control unit, only the hydraulic components of the elevator are removed, and in the place of the piston and cylinder combination and the cylinder stand, the counterweight is arranged in this very narrow space

between car and hoistway wall. This space typically has a depth of about 25 cm only. This range is just sufficient for the counterweight. By maintaining the original elevator car on the guiding rails thereof, etc., considerable expenditure can be saved in comparison with a completely new installation.

Furthermore, a deflection sheave is mounted on the car. This deflection sheave may be attached at the mounting location of the hoisting ropes of the car. For structural reasons, this is particularly preferred. In particular, there need no reflections be made as to how the deflection sheave can be mounted at a different location in sufficiently strong and safe manner. Preferably, the mounting means of the deflection sheave on the car is designed such that it can be mounted without any problem to the mounting means for the hoisting ropes provided on the car. It is particularly preferred if already existing mounting holes e.g. for bolts etc. may be utilized so that no additional adaptation work is necessary at the mounting site.

The counterweight also is provided with a deflection sheave. The deflection sheave on the counterweight may be arranged, for example, on top of the counterweight, and the axis of rotation of the sheave may be arranged either substantially in the direction of the plane between the two car guiding rails or perpendicularly to this plane. Especially in the latter case, it is particularly favourable when the sheave does not extend beyond the counterweight in upward direction, but is arranged substantially within the periphery of the counterweight. This provides for the essential advantage that there is no additional space required for the deflection sheave above the conventional path of movement of the counterweight. Accordingly, the deflection sheave on the car may also have its axis of rotation arranged substantially in the horizontal direction of the plane between the car guiding rails or perpendicularly to this plane. In the latter case, it is particularly favourable to have the sheave arranged between the car guiding rails on the rear wall of the car, so that it does not require additional space in upward direction beyond the conventional path of movement of the car. Due to the specific construction of the hydraulic elevator having the deflection sheave arranged at the upper end of the piston, there is the space available above the car and the counterweight, respectively, that was

originally required for this deflection sheave. This space is relatively limited and typically has a height of clearly less than one meter above the travel path of the car plus the prescribed height of overtravel, i.e. the safety distance to be kept above the car. This space is prescribed in its height above the car and virtually cannot be changed. Only above the counterweight is a certain scope of freedom available in the modernization of the elevator. For example, it is possible to design the counterweight, in the dimensions thereof, such that it is of lower height than the elevator car. Thus, there is additional space available above the counterweight for mounting the traction sheave drive unit or other components. The hoisting ropes preferably are flat-band hoisting ropes. By using flat-band hoisting ropes, a very small traction sheave as compared to usual traction sheaves, and correspondingly small deflection sheaves are rendered possible, so that it is particularly easy to connect the flat-band hoisting rope on the mounting location for the hoisting rope that is provided on the car. Especially due to the possibility of realizing deflection sheaves in very compact form, flat-band hoisting ropes are particularly suitable for the modernization of existing hydraulic elevators. Such a compact deflection sheave unit having a supporting and mounting construction for the deflection sheave can be designed relatively easily such that it can be arranged at the location of conventional mounting points for the hoisting ropes on the car.

An essential factor for the size of the traction sheave drive unit is the diameter of the traction sheave. With the relatively small diameters of the traction sheave that can be realized with flat-band hoisting ropes, it is also possible to design the traction sheave drive unit in very compact fashion in its entirety so that the accommodation thereof in the restricted space available above the car and/or the counterweight is relatively uncomplicated.

Preferably, the traction sheave drive unit is arranged in said space such that the axis of rotation of the traction sheave, in a plan view, is substantially parallel to the space between car and hoistway wall, i.e. substantially parallel to the plane between the car guiding rails.

Preferably, there are installed counterweight guiding rails in the elevator hoistway. In particularly expedient manner, the counterweight guiding rails can also be connected to the holding lugs for the car guiding rails. The expenditure for subsequent mounting of the counterweight guiding rails can thus be reduced considerably.

Preferably, the traction sheave drive unit is installed in the hoistway region above the car and, preferably, the axes of rotation of the deflection sheave on the counterweight, of the deflection sheave on the car and of the traction sheaves are arranged substantially parallel to each other. Above the car, there is so much room available in the elevator hoistway that a traction sheave drive unit can be accommodated there. It is immaterial in this regard whether the traction sheave drive unit, as seen in hoistway cross-section, is located above the counterweight or above the car or partly above the counterweight and partly above the car. The traction sheave drive unit preferably has a cylindrical drive motor with drive shaft as well as a traction sheave connected to the drive shaft, and in addition thereto this traction sheave drive unit is arranged in the elevator hoistway such that the axis of symmetry of the drive motor or the axis of rotation of the traction sheave, respectively, is arranged substantially parallel to said space between car and hoistway wall. Such an elongate traction sheave drive unit is relatively easy to arrange above the car or above the counterweight in the elevator hoistway. In particular, such a drive unit has a substantially cylinder-shaped overall configuration with a diameter of less than 40 cm, preferably less than 30 cm and in particular less than 25 cm. Such a compact drive unit can be positioned also in narrow elevator hoistways in particularly convenient manner in terms of space.

Preferably, the traction sheave and/or the deflection sheave has a diameter of less than 20 cm, particularly less than 15 cm and most preferably of about 10 cm or less. Such small traction sheaves, in accordance with the current state of the art, can be realized in connection with flat-band hoisting ropes only. This renders possible completely different and considerably more compact types of roping than with conventional sheaves using conventional hoisting ropes.

Preferably, a hoistway head mounting unit is mounted in the hoistway above the car/counterweight, said mounting unit having the traction sheave drive unit as well as the free ends of the flat-band hoisting ropes attached thereto. The hoistway head mounting unit may be mounted to the hoistway walls. Alternatively, it is also possible to mount the hoistway head mounting unit on the counterweight guiding rails and/or the car guiding rails so that substantially the entire load is taken up via the rails. The hoistway head mounting unit may also be mounted on the hoistway ceiling. A combination of various mounting types is conceivable as well.

Furthermore, the invention relates to a retrofitting set for retrofitting a hydraulic elevator arranged in an elevator hoistway so as to form a traction sheave elevator, comprising:

(a) a counterweight having a thickness that is less than the space between car and hoistway wall;
(b) a traction sheave drive unit to be mounted in said elevator hoistway; and
(c) a set of flat-band hoisting ropes.

The retrofitting set preferably comprises counterweight guiding rails, in particular counterweight guiding rails that can be mounted on the car guiding rails or the holding lugs of the car guiding rails. The retrofitting set preferably comprises a traction sheave drive unit comprising a cylindrical drive motor having a drive shaft, and a traction sheave connected to the drive shaft. Moreover, the retrofitting set preferably comprises a hoistway head mounting unit for attachment of the traction sheave drive unit and the free ends of the flat-band hoisting ropes.

The hoistway head mounting unit preferably comprises a main beam designed such it can be mounted on both ends thereof in the hoistway walls and such that the traction sheave drive can be mounted suspended therebelow, as well as a transverse beam mounted on said main beam transversely thereto and having at both ends thereof mounting means for mounting the ends of the flat-band hoisting ropes. Basically, the advantage is to be seen in attaching the free ends to the same mounting unit on which the traction sheave drive unit is

mounted as well. Then, it will only be necessary to mount one single beam or beam combination in the hoistway in sufficiently stable manner. All additional mounting locations required for the elevator system will be arranged thereon. In case of necessity for reasons of statics, it is also possible to design the transverse beam such that both ends thereof can be mounted in the hoistway wall. The traction sheave drive unit accordingly would have to be mounted in a direction transverse to this beam, e.g. on a side beam.

The invention, moreover, relates to a traction sheave elevator comprising a traction sheave drive unit having a traction sheave, a car guided on car guiding rails, a counterweight and a set of flat-band hoisting ropes, said car and said counterweight being each suspended on said flat-band hoisting ropes by means of a deflection sheave and the axes of rotation of said traction sheave and said deflection sheaves being arranged substantially parallel to each other, characterized in that the car guiding rails are arranged on one side of said car such that the car is guided on said car guiding rails in cantilever fashion; that said counterweight is arranged on the side of the car on which said car guiding rails are provided; that the axes of rotation of said traction sheave and said deflection sheaves are arranged such that they extend in the direction from one car guiding rail to the other car guiding rail; and that the deflection sheave is arranged in the region of the rear wall of the car and substantially between the car guiding rails.

This traction sheave elevator preferably is provided with a hoistway head mounting unit as described hereinbefore.

The roping of the traction sheave elevator preferably is as follows: the flat-band hoisting ropes extend from a first mounting means on the counterweight, the so-called counterweight-side dead point, in substantially vertical downward direction to the deflection sheave of the counterweight, from there in substantially vertical upward direction to the traction sheave, from there again in substantially vertical downward direction to the deflection sheave of the car and from there again in substantially vertical upward direction to a second mounting means on the car, the car-side dead point.

The invention and further developments of the invention will be described in more detail hereinafter by way of an embodiment illustrated in the drawings in which

Fig. 1 shows a hydraulic elevator according to the prior art;

Fig. 2 shows the hydraulic elevator of Fig. 1 after retrofitting thereof to a traction sheave elevator; and

Fig. 3 shows a schematic illustration of the roping and suspension of the traction sheave drive unit according to the present invention.

The basic construction of a hydraulic elevator of the prior art has already been described hereinbefore with reference to Fig. 1. For retrofitting this elevator, the car 2 is moved in the elevator hoistway along the car guiding rails 4 to the lowest possible point and supported from below. This can be effected either by moving the car 2 onto the buffer 20 provided on the hoistway floor until said buffer carries the load of car 2. As an alternative, the car can be supported in the hoistway by corresponding temporary supporting frameworks.

Thereafter, the hoisting ropes 16 are removed, and the hydraulic fluid is discharged from the hydraulic drive unit. Upon closure of the hydraulic drive unit, the latter, i.e. the hydraulic tank (not shown), the pump (not shown) as well as the piston and cylinder combination 6 and the corresponding connecting lines are removed from the elevator hoistway as well, so that the space between the elevator car 2 and the hoistway wall in which the piston and cylinder combination 6 was arranged is empty.

This space between car and hoistway wall typically is of a size that is considerably smaller than 50 cm, in particular smaller than 35 cm and in many cases even just 25 cm or less. In this space, the counterweight guiding rails (not shown) as well as a counterweight 22 need to be arranged now. Furthermore, a hoistway head mounting unit 24 has to be mounted in the hoistway above car 2

and counterweight 22, respectively. The hoistway head mounting unit 24 has a first C-shaped main beam 26 as well as a second, also C-shaped main beam 28 that are arranged substantially parallel to each other and have their ends each attached in or on the hoistway wall. Suspended from the bottom side of these main beams 26, 28 is a substantially cylinder-shaped traction sheave drive unit 30. On the top side of the main beams 26, 28, there is arranged a transverse beam 32 provided at the ends 34, 36 thereof with mounting means 38, 40, 42, 44 for mounting ends of flat-band hoisting ropes 46.

The counterweight guiding rails 48 can be attached either directly to the hoistway wall or, alternatively, are also attached to corresponding mounting brackets for the car guiding rails 4.

Counterweight 22 may be delivered and installed as an integral unit. However, it is expedient to provide the counterweight in the form of individual frame components and to mount the latter directly in the hoistway. This avoids the problem as to how the heavy and bulky counterweight can be brought into the elevator hoistway. In case of assembling the unit from separate parts, it is possible, for example, for the technician to stand on the roof of the car 2 and to assemble the counterweight from this location on the counterweight guiding rails.

From the roof of the car, it is also comparatively unproblematic for the technician to mount the deflection sheave 50 on the car 2. It is also possible to attach the deflection sheave 50 to the car 2 at the bottom, in the region of the car floor. It is to be pointed out that the guide shoes by means of which the car 2 is connected to the car guiding rails typically project a certain length, i.e. about 10 cm upwardly beyond the roof of the car, so that the deflection sheave 50 can be mounted to the car 2 without this requiring any additional hoistway space whatsoever in upward direction, as compared to the car 2 in case of the hydraulic elevator according to Fig. 1. The deflection sheave 50 substantially has the shape of a cylindrical roller in which, in the embodiment illustrated, there are arranged four grooves 92 for guiding the flat-band hoisting ropes 66. This deflection sheave 50 is rotatably disposed on a support 54. This support

preferably is arranged such that it can be attached to car 2 using the mounting elements provided for attaching the rope ends of the hydraulic elevator according to Fig. 1. For example, the support 54 for the deflection sheave 50 has screw holes or elongate holes for attachment by means of screws or bolts suited for corresponding means on car 2.

Furthermore, the flat-band hoisting ropes 46 are connected and the traction sheave drive unit 30 is connected to the elevator control unit (not shown). After performing an empty run, during which the positions of the individual storeys etc. are programmed in the elevator control unit, the modified elevator is basically ready for use.

Fig. 3 illustrates the roping path of the flat-band hoisting ropes. In particular, it can be seen that the hoisting rope extends from a counterweight mounting means 42 in substantially vertical downward direction to the deflection sheave 56 on counterweight 22. From there, the rope is passed in substantially vertical upward direction to the traction sheave 58 of the traction sheave drive unit 30. From there, the flat-band hoisting rope 46 again extends in substantially vertical downward direction to the deflection sheave 50 on the car and from there in substantially vertical upward direction to the car mounting means 38.

It can also be seen very clearly in Fig. 3 that the axes of rotation 60, 62 and 64 of the traction sheave 58 and of the deflection sheaves 50 and 56 are arranged substantially parallel to each other and are substantially parallel to the gap between car and hoistway wall 66.

Referring again to Fig. 2, it can be seen that the traction sheave drive unit 30 has a, very roughly speaking, cylinder-shaped drive motor 68, with the traction sheave 58 being directly connected to the drive shaft (not shown) of the same. In addition thereto, the brake 70 is provided on the side of the traction sheave 58 located opposite motor 68.

The flat-band hoisting ropes 46 are steel-core-reinforced polyurethane belts which are of very light weight, very durable and flexible. In comparison with the

conventional hoisting ropes, these flat-band hoisting ropes 46 permit very narrow radii of curvature of the traction sheave 58 and of the deflection sheaves 50 and 56. In addition thereto, these flat-band hoisting ropes 46 are very quiet as the otherwise typical metallic rolling noise of the steel cores upon passage of the PU jacket is not present. Furthermore, there is the fact that lubrication of these ropes is not necessary and that oil or lubrication is not necessary for the traction sheave drive unit 30, either, as the latter does not require a transmission and has maintenance-free ball bearings that are sealed. As compared to normal traction sheave elevators, the environmental standard is thus significantly enhanced, since the risk of any lubricants leaking to the environment is extremely minimized.

Claims

1. A method of retrofitting a hydraulic elevator arranged in an elevator hoistway so as to form a traction sheave elevator, said hydraulic elevator comprising a car (2) guided on car guiding rails (4), a hydraulic drive unit provided in the space between car (2) and hoistway wall (66), as well as a hoisting rope from which the car (2) is suspended and which has the hydraulic drive unit connected thereto, said method comprising the following steps:
   (a) unmounting said hydraulic drive unit and said hoisting rope;
   (b) installing a counterweight (22) with deflection sheave (56) in the space between the car (2) and the hoistway wall (66);
   (c) installing a traction sheave drive unit (30) having a traction sheave (58) in said elevator hoistway such that the traction sheave drive unit is arranged in the space available above the car (2) and/or the counterweight (22);
   (d) installing a deflection sheave (50) on the car (2);
   (e) installing mounting means (38, 40, 42, 44) for mounting the ends of the hoisting ropes (46) at the top in the elevator hoistway; and
   (f) installing hoisting ropes (46) such that these are passed around the deflection sheaves (50; 56) on the counterweight (22) and the car (2) and around the traction sheave (58) and are attached at their ends to a mounting means each.

2. The method of claim 1,
wherein said step of installing hoisting ropes comprises installing of flat-band hoisting ropes.

3. The method of claim 1 or 2,
wherein the traction sheave drive unit (30) is installed in the elevator hoistway such that the axis of rotation (62) of the traction sheave (58), as seen in a plan view, is substantially parallel to said space between car and hoistway wall.

4. The method of any of claims 1 to 3,
comprising the further step of installing counterweight guiding rails (48) in the elevator hoistway.

5. The method of any of claims 1 to 4,
wherein said step of installing the traction sheave drive unit (30) comprising installing the same in the hoistway region above the car (2).

6. The method of claim 5,
wherein said step of installing the traction sheave drive unit (30) comprises installing a traction sheave drive unit (30) having a cylindrical drive motor (68) with a drive unit, as well as a traction sheave (58) connected to the drive shaft, such that the axis of rotation of the drive motor (68), as seen in a plan view, is substantially parallel to said space between car and hoistway wall.

7. The method of claim 6,
wherein said step of installing of the traction sheave drive unit (30) comprises installing a hoistway head mounting unit (24) to which are attached the traction sheave drive unit (30) and the mounting means (38; 40; 42; 44).

8. The method of claim 7,
comprising the step of mounting the hoistway head mounting unit (24) to the hoistway walls.

9. A retrofitting set for retrofitting a hydraulic elevator arranged in an elevator hoistway so as to form a traction sheave elevator according to any of claims 1 to 8, comprising:
   (a) a counterweight (22) having a deflection sheave (56) and having a thickness that is less than the space between car (2) and hoistway wall (66);
   (b) a traction sheave drive unit (30) to be mounted in said elevator hoistway;

(c) a deflection sheave (50) to be mounted to the car;

(d) a set of hoisting ropes (46); and

(e) mounting means (38; 40; 42; 44) for attaching the ends of the hoisting ropes (46) at the top of the elevator hoistway..

10. The retrofitting set of claim 9,
wherein said hoisting ropes are flat–band hoisting ropes (46).

11. The retrofitting set of claim 9 or 10,
comprising counterweight guiding rails (48).

12. The retrofitting set of any of claims 9 to 11,
wherein said traction sheave drive unit (30) comprises a cylindrical drive motor (68) having a drive shaft, and a traction sheave (58) connected to the drive shaft.

13. The retrofitting set of any of claims 9 to 12,
comprising a hoistway head mounting unit (24) for attachment of the traction sheave drive unit (30) and mounting means (38; 40; 42; 44).

14. A hoistway head mounting unit (24) for a retrofitting set according to claim 13, comprising a main beam (26, 28) designed such it can be mounted on both ends thereof in the hoistway walls and such that the traction sheave drive (30) can be mounted suspended therebelow, and comprising a transverse beam (32) mounted on said main beam (26, 28) transversely thereto and having at both ends thereof said mounting means (38, 40, 42, 44) for mounting the ends of the flat–band hoisting ropes (46).

15. A traction sheave elevator comprising a traction sheave drive unit (30) having a traction sheave (58), a car (2) guided on car guiding rails (4), a counterweight (22) and a set of hoisting ropes (46), said car (2) and said counterweight (22) being each suspended on said hoisting ropes (46) by means of a deflection sheave (50, 56),
characterized in

that said car guiding rails (4) are arranged on one side of said car (2) such that the car (2) is guided on said car guiding rails (4) in cantilever fashion;
that said counterweight (22) is arranged on the side of the car (2) on which said car guiding rails (4) are provided; and
that the deflection sheave (50) of said car (2) is arranged in the region of the rear wall of said car (2) and substantially between said car guiding rails (4).

16. The traction sheave elevator of claim 15,
characterized in that axes of rotation (60, 62, 64) of the traction sheave (58) and of the deflection sheave (50, 56) are arranged substantially parallel to each other and extending from one car guiding rail (4) to the other car guiding rail (4), and in that a hoistway head mounting unit (24) is provided comprising a main beam (26, 28) that is mounted on both ends thereof in the hoistway walls so as to extend substantially parallel to the axes of rotation (60, 62, 64) of the traction sheave (58) and the deflection sheaves (50, 56) and that has the traction sheave drive unit (30) connected thereto, and comprising a transverse beam (32) mounted on said main beam (26, 28) transversely thereto and having at both ends thereof mounting means (38, 40, 42, 44) for mounting the ends of the flat-band hoisting ropes (46).

17. The traction sheave elevator of claim 15 or 16,
characterized in that the flat-band hoisting ropes (46) are passed from a first mounting means (42, 44) in substantially vertical downward direction to the deflection sheave (56) of the counterweight (22), from there in substantially vertical upward direction to the traction sheave (58), from there again in substantially vertical downward direction to the deflection sheave (50) of the car (2) and from there again in substantially vertical upward direction to a second mounting means (38, 40).

Application No:	GB 0225776.4	**Examiner:**	Dave McMunn
Claims searched:	1-17	**Date of search:**	6 May 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1,3-5,9,11,13-16	GB 2,352,221 A	(LG-OTIS). See eg. Figs 11, 17 & 23
X	1,3-5,9,11,13,15,16	GB 2,223,471 A	(KONE ELEVATOR). See Figs
X	1,3-9,11-17	EP 0,905,081 A2	(TOSHIBA). See eg. Figs 4,16,37
X	1,3-5,9,11,13-16	EP 0,710,618 A2	(AULANKO). See Fig
A	2,10	WO 99/43885 A1	(OTIS). See Figs
A	2,10	WO 99/43599 A1	(OTIS). See Figs
A	2,10	SU 521209	(BOROKHOVICH). See Figs & English abstract

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V]:

B8L

Worldwide search of patent documents classified in the following areas of the IPC[7]:

B66B

The following online and other databases have been used in the preparation of this search report :

WPI, EPODOC, JAPIO.